

Amendment to the Claims:

1. (Currently amended) A magnetic resonance imaging system including:

a ~~means for encoding~~ magnetic resonance imaging scanner configured to encode magnetic resonance in at least a readout direction, the encoding including applying a read magnetic field gradient profile;

a plurality of receive coils for receiving magnetic resonance signals;

a sampling means for sampling the receive coils during application of the read magnetic field gradient profile to acquire samples from each receive coil at a measurement sampling rate, wherein the sampling means undersamples the receive coils at a reduced sampling rate such that the intermediate reconstructed images include aliasing in at least the readout direction;

a means for reconstructing the magnetic resonance samples acquired from each coil into a corresponding intermediate reconstructed image, the intermediate reconstructed images having a measurement field of view ~~and a measurement spatial resolution~~ in the readout direction; and

a means for combining the intermediate reconstructed images based on coil sensitivity factors to produce a final reconstructed image having a final field of view ~~and a final spatial resolution~~ in the readout direction, ~~wherein at least one of the final field of view and the final spatial resolution~~ that is increased over a corresponding one of the measurement field of view ~~and the measurement spatial resolution~~ in the readout direction.

2. (Previously presented) The magnetic resonance imaging system as set forth in claim 1, further including:

a coils sensitivities processor that computes coils sensitivities data based on a calibration image.

3. (Previously presented) The magnetic resonance imaging system as set forth in claim 2, wherein the combining means solves a set of linear equations relating pixel values of the intermediate reconstructed images and coils sensitivities data computed

by the coils sensitivities processor to compute a pixel value of the final reconstructed image.

4. (Currently amended) The magnetic resonance imaging system as set forth in claim 1, wherein the ~~means for encoding magnetic resonance includes:~~ a magnetic resonance imaging scanner ~~that~~ encodes magnetic resonance samples in both phase encode and readout directions.

5. (Previously presented) The magnetic resonance imaging system as set forth in claim 4, wherein the sampling means also acquires magnetic resonance samples encoded in the phase encode direction, the magnetic resonance imaging scanner and the receive coils cooperating to effect sensitivity encoding in the phase encode direction.

6. (Previously presented) The magnetic resonance imaging system as set forth in claim 4, wherein the sampling means also acquires magnetic resonance samples encoded in the phase encode direction, the magnetic resonance imaging scanner and the receive coils cooperating to effect variable density sensitivity encoding in the phase encode direction.

7. (Previously presented) The magnetic resonance imaging system as set forth in claim 4, wherein:

the magnetic resonance signals are encoded in the phase encode direction, and the sampling means acquires samples that are encoded in the phase encode direction and the readout direction with a sufficiently low sampling density that the intermediate reconstructed images are aliased in each of the phase encode direction and the readout direction; and

the combining performed by the combining means unfolds the intermediate reconstructed images in both the phase encode direction and the readout direction to produce the final reconstructed image with the aliasing removed.

8. (Currently amended) The magnetic resonance imaging system as set forth in ~~claim 4~~ claim 9, wherein:

~~the sampling means samples the receive coils to read the magnetic resonance samples over a shortened read gradient profile such that the reconstructing means produces the intermediate reconstructed images with degraded measurement spatial resolution in the readout direction compared with the final spatial resolution in the readout direction;~~

the sampling ~~means~~ circuit samples the receive coils at a sampling rate in the phase encode direction which is sufficiently low such that the reconstructing means produces the intermediate reconstructed images with aliasing in the phase encode direction; and

the combining ~~preformed~~ performed by the combining means produces the final reconstructed image with ~~both the spatial resolution degradation in the readout direction and the aliasing in the phase encode direction removed.~~

9. (Currently amended) The A magnetic resonance imaging system ~~as set forth in claim 1~~, wherein including:

a magnetic resonance imaging scanner configured to encode magnetic resonance in at least a readout direction, the encoding including applying a read magnetic field gradient profile;

a sampler including a plurality of receive coils for receiving magnetic resonance signals and a sampling circuit for sampling the receive coils during application of the read magnetic field gradient profile to acquire samples from each receive coil, the sampling ~~means acquires~~ circuit acquiring samples in the readout direction that map to low frequency readout values of a k-space and not to higher frequency readout values of the k-space;

a reconstruction processor configured to reconstruct the magnetic resonance samples acquired from each coil into a corresponding intermediate reconstructed image, the intermediate reconstructed images having a measurement spatial resolution in the readout direction; and

a means for combining the intermediate reconstructed images based on coil sensitivity factors to produce a final reconstructed image having a final spatial

resolution in the readout direction that is increased over the measurement spatial resolution in the readout direction.

10. (Currently amended) The magnetic resonance imaging system as set forth in claim 9, wherein the sampling ~~means~~ circuit samples the low frequency readout values of the k-space over a shortened read gradient profile.

11. (Canceled)

12. (Currently amended) The magnetic resonance imaging system as set forth in ~~claim 11~~ claim 1, wherein the sampling means performs the undersampled receiving using a sampling time for each sample that is greater than a minimum sampling time for sampling at a maximum readout sampling rate.

13. (Currently amended) The magnetic resonance imaging system as set forth in claim 1, wherein ~~the measurement sampling rate is sufficiently low that aliasing occurs in the intermediate reconstructed images in the readout direction, and the~~ means for combining unfolds the intermediate reconstructed images based on the coil sensitivity factors to remove the aliasing in the readout direction, the final field of view being increased over the measurement field of view.

14. (Currently amended) The magnetic resonance imaging system as set forth in ~~claim 1~~ claim 9, wherein ~~the read magnetic field gradient profile is shortened such that the measurement spatial resolution is less than the final spatial resolution, and the~~ means for combining implements an inverting of a sensitivity matrix constructed from the coil sensitivity factors.

15-16. (Canceled)

17. (Currently amended) A magnetic resonance imaging method including:
encoding magnetic resonance signals in at least a readout direction with a read magnetic field gradient profile;

sampling the magnetic resonance signals in the readout direction using a plurality of receive coils to acquire magnetic resonance samples from each coil at a measurement sampling rate undersampled in the readout direction;

reconstructing the magnetic resonance samples acquired from each coil into a corresponding intermediate reconstructed image, the reconstructed images having a measurement field of view ~~and a measurement spatial resolution~~ in the readout direction and having aliasing in the readout direction due to the undersampling in the readout direction; and

combining the intermediate reconstructed images based on coil sensitivity factors to produce a final reconstructed image having a final field of view ~~and a final spatial resolution~~ in the readout direction, ~~wherein at least one of the final field of view and the final spatial resolution that~~ is increased over a corresponding ~~one of the measurement field of view and the measurement spatial resolution~~ in the readout direction, the combining restoring field of view in the readout direction and removing the aliasing in the readout direction.

18. (Original) The magnetic resonance imaging method as set forth in claim 17, wherein the encoding of magnetic resonance signals includes:

encoding the magnetic resonance signals using transmit SENSE.

19. (Previously presented) The magnetic resonance imaging method as set forth in claim 17, wherein the combining based on the coils sensitivities produces a final reconstructed image having a higher spatial frequency content in the readout direction than any one of the intermediate reconstructed images.

20. (Original) The magnetic resonance imaging method as set forth in claim 19, wherein the high spatial frequency content of the final reconstructed image is generated during the combining by transforming aliasing in the readout direction of the intermediate reconstructed images into image data outside a field of view of the intermediate reconstructed images.

21. (Currently amended) ~~The~~ A magnetic resonance imaging method ~~as set forth in claim 17, including:~~

encoding magnetic resonance signals in at least a readout direction with a read magnetic field gradient profile;

sampling the magnetic resonance signals in the readout direction using a plurality of receive coils to acquire magnetic resonance samples from each coil in the central region of k-space in the readout direction while completely omitting sampling of high readout k-values in the readout direction;

reconstructing the magnetic resonance samples acquired from each coil into a corresponding intermediate reconstructed image, the reconstructed images having a measurement spatial resolution in the readout direction; and

combining the intermediate reconstructed images based on coil sensitivity factors to produce a final reconstructed image having a final spatial resolution in the readout direction that is increased over the measurement spatial resolution in the readout direction and ~~wherein the sampling includes at least one of: sampling is performed~~ over a shortened read magnetic field gradient profile such that the combining restores resolution in the readout direction; ~~and~~

~~sampling at a reduced sampling rate such that the combining restores field of view in the readout direction.~~